



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/801,624	03/15/2004	Tamer Kadous	030301	2928

23696 7590 07/20/2010
QUALCOMM INCORPORATED
5775 MOREHOUSE DR.
SAN DIEGO, CA 92121

EXAMINER

OVEISSI, DAVID M

ART UNIT	PAPER NUMBER
----------	--------------

2464

NOTIFICATION DATE	DELIVERY MODE
-------------------	---------------

07/20/2010

ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

us-docketing@qualcomm.com

Office Action Summary	Application No. 10/801,624	Applicant(s) KADOUS, TAMER	
	Examiner DAVID OVEISSI	Art Unit 2464	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 June 2010.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-19,21-24,26-29 and 31-49 is/are pending in the application.
- 4a) Of the above claim(s) 2, 20, 25, 30, and 40 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3-19,21-24,26-29,31-39 and 41-49 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 15 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claims **2, 20, 25, 30**, and **40** have been cancelled.

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 6/2/2010 has been entered.

Response to Arguments

2. Applicant's arguments with respect to claims 1, 3-19, 21-24, 26-29, 31-38 and 41-49 have been considered but are moot in view of the new grounds of rejection.

Applicant argued that **Piiranien** does not teach channel coding in independent claim 1.

Examiner respectfully disagrees. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., channel coding) are not recited in the rejected

Art Unit: 2464

claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Claim Rejections - 35 USC § 112

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1, 8, 10, 13, 15, 21, 23, 26, 41, and 49 rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claims 1, 8, 10, 13, 15, 21, 23, 26, 41, and 49 recites the limitation “wherein each of the plurality of symbol blocks is transmitted at most once to the receiver”. There is no support for this limitation in the specification therefore this is a new matter.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 28, 33, 35, and 37 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

For claim 28 the recited limitation “final iteration” is vague and indefinite. It is not clear what the final iteration is. Range of iterations must be specified otherwise it creates an infinite loop. It is not what the last iteration is. Is it 1, 10, 100, or infinity.

For claims 29, 31, 32, and 45 are rejected because of their dependency from claim 28.

For claim 33 the recited limitation “a final iteration” is vague and indefinite. It is not clear what the final iteration is. It is not what the last iteration is. Is it 1, 10, 100, or infinity.

For claims 34 and 46 are rejected because of their dependency from claim 33.

For claim 35 the recited limitation “a final iteration” is vague and indefinite. It is not clear what the final iteration is. It is not what the last iteration is. Is it 1, 10, 100, or infinity.

For claims 36 and 47 are rejected because of their dependency from claim 33.

For claim 37 the recited limitation “a final iteration” is vague and indefinite. It is not clear what type the last iteration is. It is not what the last iteration is. Is it 1, 10, 100, or infinity.

For claims 38 and 48 are rejected because of their dependency from claim 37.

Claims 1, 8, 10, 13, 15, 21, 23, 26, 41, and 49 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1, 8, 10, 13, 15, 21, 23, 26, 41, and 49 recites the limitation “transmitting remaining ones of the plurality of symbol blocks, one symbol block at a time, until the data packet is recovered correctly by the receiver or all of the plurality of symbol blocks are transmitted, wherein each of the plurality of symbol blocks is transmitted at most once to the receiver”. It is not clear how the symbols are transmitted only once and they are recovered fully, if there were errors. If the symbols were not recovered correctly, it requires at least one retransmission which contradicts the first portion of the limitation.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 3, 5-14, and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Piirainen (US 7,031,419 B2)** in view of Applicant Admitted Prior Art (**AAPA**) further in view of **Lakkis (US 7,031,371 B1)**.

For claims 1, 10, 13, and 41 **Piirainen** with exception of each symbol block including different coded information limitation for the data packet teaches a method/transmitter/apparatus/processor readable medium of performing incremental redundancy (IR) (see column 7 line 46 "Incremental redundancy") transmission in a wireless multiple-input multiple-output (MIMO) communication system(see column 2 line 6 "MIMO"), comprising:

processing a data packet in accordance with the selected rate to obtain a plurality of symbol blocks, each symbol block including different coded information for the data packet (see abstract "symbol blocks", column 1 lines 28--39 "in order to increase data rate select a higher rate modulation", column 1 lines 51-55 "diversity is achieved by coding each symbol block with different selected code", column 2 lines 42-43 "predetermined format being selected so that symbol block is transmitted from space-time block coding", column 2 lines 45-65 " a data packet processing based on the selected code", column 3 lines 20-21 "utilization of both MIMO and space-time coding", column 3 lines 54 "the coding included in retransmission enables noise immune transmission as the diversity increases compared to the case of a good channel", column 7 lines 45-55 "convolution coding and encoded bits are divided in blocks", column 8 lines 1-5 "information encoded and divided into different block", and column 9 lines 61-63"selection can be made according to the known principles of space-time block coding");

transmitting a first symbol block from a-the plurality of transmit antennas at the transmitter to the plurality of receive antennas at the receiver, wherein the first symbol

Art Unit: 2464

block is one of the plurality of symbol blocks (see abstract “symbols are divided into blocks and transmitted from transceivers to transceivers”); and transmitting remaining ones of the plurality of symbol blocks, one symbol block at a time, until the data packet is recovered correctly by the receiver or all of the plurality of symbol blocks are transmitted, wherein each of the plurality of symbol blocks is transmitted at most once to the receiver (see abstract “symbols are divided into blocks (plurality of blocks) and transmitted from transceivers to transceivers and checking whether the blocks were received successfully and combining blocks”).

Piirainen does not expressly teach obtaining a selected rate for data transmission on a MIMO channel between a plurality of transmit antennas at a transmitter and a plurality of receive antennas at a receiver, the selected rate indicating a particular data rate, or a particular coding scheme, or a particular code rate, or a particular modulation scheme, or a particular data packet size, or a combination thereof limitation;

However, **AAPA** teaches this limitation (see paragraph 6 “a selected rate may indicate data rate, coding scheme, modulation scheme, packet size, and so on”).

Thus, it would have been obvious to a person of ordinary skill in the art at time of invention to use the **AAPA** teachings in the data transmission and reception system of **Piirainen** to provide a selectable rate for a MIMO system.

This combination is possible because both **Piirainen** and **AAPA** deal with the same problem of retransmission of symbol block when the received block is in error.

Piirainen/AAPA does not teach each symbol block including different coded information for the data packet limitation.

However, **Lakkis** this limitation (see column 1 line 40 “different code is assigned”, column 7 lines 24-25 “different code chips applied to different symbols”, and column 8 lines 64-67 “ variety of different codes”).

Thus, it would have been obvious to the person of ordinary skill in the art at the time of invention to combine the teachings of **Lakkis**, AAPA, with teachings **Piirainen** to provide a selectable rate for a MIMO system.

The motivation for this combination is to improve the throughput of MIMO system under various channel conditions.

For claims 3, 11-12, and 14 **Piirainen** teaches a method/transmitter/apparatus, wherein the processing includes

encoding the data packet in accordance with the particular coding scheme indicated by the selected rate to obtain a coded packet (see abstract column 9 lines 61-63 “selection is made based on STBC”, Fig. 4 “packet coding; division into bursts, and division of burst into groups”),

partitioning the coded packet into a plurality of coded subpackets (see abstract column 9 lines 61-63 “selection is made based on STBC”, Fig. 4 “packet coding; division into bursts, and division of burst into groups”), and

modulating the plurality of coded subpackets in accordance with the particular modulation scheme indicated by the selected rate to obtain the plurality of symbol

Art Unit: 2464

blocks (see column 1 lines 28-29 “data rate and modulation” and column 4 line 18 “CDMA and FDMA”).

For claim 5 **Piirainen** teaches a method, further comprising:

Receiving, at the transmitter, a negative acknowledgment (NAK) (see Fig. 4 “NACK”) for the packet from the receiver; and

transmitting a next symbol block among the remaining ones of the plurality of symbol blocks in response to receiving the NAK (see Fig. 4 “NACK”).

For claim 6 **Piirainen** teaches a method, wherein the MIMO system utilizes orthogonal frequency division multiplexing (OFDM), and wherein each of the plurality of symbol blocks is transmitted from a plurality of subbands of the plurality of transmit antennas, if the symbol block is selected for transmission (see Fig. 3 “MIMO data transmission” and column 4 line 18-19 “OFDM”).

For claim 7 **Piirainen** teaches a method, wherein at least two data packets are each processed in accordance with the selected rate to obtain at least two pluralities of symbol blocks, one plurality of symbol blocks for each data packet, and wherein at least two symbol blocks for the at least two data packets are transmitted simultaneously from the plurality of transmit antennas to the plurality of receive antennas (see abstract “dividing symbols to be transmitted into blocks and transmitting blocks using each antenna and the division is based on the number of antennas” and column 9 line 32 “simultaneously transmission”).

For claim 8 **Piirainen** teaches a method of performing incremental redundancy (IR) transmission in a wireless multiple-input multiple-output (MIMO) communication system (see Fig. 3 “MIMO transmission”), comprising:

processing a data packet to obtain a plurality of symbol blocks, each symbol block including different coded information for the data packet (see abstract “plurality of symbol blocks have been obtained and processed”);

transmitting a first symbol block from a plurality of transmit antennas at a transmitter to a plurality of receive antennas at a receiver, wherein the first symbol block is one of the plurality of symbol blocks (see abstract “transceiver, symbol blocks and antennas”); and

transmitting remaining ones of the plurality of symbol blocks, one symbol block at a time, until the data packet is recovered correctly by the receiver or all of the plurality of symbol blocks are transmitted, wherein the MIMO system utilizes orthogonal frequency division multiplexing (OFDM), and wherein each of at least two symbol blocks for at least two data packets is transmitted diagonally across a plurality of subbands and the plurality of transmit antennas, wherein each of the plurality of symbol blocks is transmitted at most once to the receiver (see Fig. 3 “MIMO data transmission illustration”, column 4 line 19 “OFDM” and column 7 lines 5-6 “diagonal transmission”).

For claim 9 **Piirainen** teaches a method, wherein the MIMO system utilizes orthogonal frequency division multiplexing (OFDM), and the method further comprising:

Processing each N_p data packets are each processed in accordance with the selected rate to obtain N_p pluralities of symbol blocks, one plurality of symbol blocks for each data packet, where N_p is equal to or greater than one and is selected based on a rank of the MIMO channel, and

transmitting N_p symbol blocks for the N_p data packets are transmitted simultaneously diagonally across a plurality of subbands and the plurality of transmit antennas (see Fig. 3 “MIMO data transmission illustration”, column 4 line 19 “OFDM”, and column 6 lines 55-60 “formula 1”).

6. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Piirainen** in view of Applicant Admitted Prior Art (**AAPA**) further in view of **Lakis**, and further in view of **Tarokh** et al. (US 2004/0057530 A1).

For claim 4 **Piirainen** in view of **AAPA** further in view of **Lakis** does not teach a method, wherein the coding scheme is a Turbo code, and wherein the first symbol block includes systematic bits for the data packets. However, **Tarokh** teaches this limitation (see paragraph 52” Turbo code”). Thus, it would have been obvious to a person of ordinary skill in the art at the time of invention to use a coding scheme such as Turbo code taught by **Tarokh** in the encoder of **Piirainen** to adapt the symbol block with code which is more suitable with channel condition variations. This combination is possible because **Piirainen** uses the encoder of **Tarokh** (see column 9 line 63 **Tarokh**”).

Art Unit: 2464

The motivation for this combination is to provide a symbol block transmitter that is adaptable to changes in the channel conditions.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 15-19, 22-24, 26-29, 31-40, and 49 are rejected under 35 U.S.C. 103 (a) as being unpatentable over **Tarokh (US 2004/0057530 A1)** in view of **Lakkis (US 7,031,371 B1)**.

For claims 15, 23, 26, and 49 **Tarokh** with exception of each symbol block including different coded information for the data packet teaches a method/receiver/apparatus/processor-readable medium of receiving an incremental redundancy (IR) transmission in a wireless multiple-input multiple-output (MIMO) communication system (see abstract "IR" and paragraph 8 "MIMO"), comprising:

obtaining a block of detected symbols for a data packet, wherein the detected symbol block is an estimate of a data symbol block transmitted from a plurality of transmit antennas at a transmitter and received by a plurality of receive antennas at a receiver, and wherein the data symbol block is one of a plurality of data symbol blocks generated for the data packet, each symbol block including different coded information

Art Unit: 2464

for the data packet, wherein each of the plurality of symbol blocks is transmitted at most once to the receiver (see abstract “a transmitter sends packets via blocks of symbol to the receive”, Fig. 5 “channel estimation, STC Decoder, Channel decoder, and Error detection”, paragraph 9 “detection algorithm”, paragraph 74 “detect decoded errors”, and paragraph 8 “antennas”);

decoding all detected symbol blocks obtained for the data packet to provide a decoded packet (see abstract “decoding symbols”);

determining whether the decoded packet is correct or in error (see abstract “decoding of incorrectly received packets”); and

repeating the obtaining, decoding, and determining for another one of the plurality of data symbol blocks if the decoded packet is in error (see the abstract “ a hybrid ARQ feedback mechanism being used to repeat the obtaining, decoding, and error detection” and paragraph 24 “automatic repeat”),

Tarokh does not teach each symbol block including different coded information for the data packet.

However, **Lakkis** this limitation (see column 1 line 40 “different code is assigned”, column 7 lines 24-25 “different code chips applied to different symbols”, and column 8 lines 64-67 “ variety of different codes”).

Thus, it would have been obvious to the person of ordinary skill in the art at the time of invention to combine the teachings of **Lakkis** with teachings **Piirainen** to arrive at the claimed invention.

The motivation for this combination is to improve the throughput of MIMO system.

For claims 16, 24, and 27 **Tarokh** teaches a method/receiver/apparatus, further comprising:

receiving a block of received symbols for the data symbol block; and
processing the received symbol block to obtain the detected symbol block (see abstract “obtained blocks of symbols are sent via transmitter to receiver”, Fig. 5 CRC and ERROR DETECTION”, and paragraph 63 “incoming bits, packets, or symbol are monitored and in case error HARQ algorithm is performed”).

For claim 17 **Tarokh** teaches a method, wherein the processing the received symbol block comprises processing the received symbol block ~~detecting~~ is based on a minimum mean square error (MMSE) detector, a maximal ratio combining (MRC) detector, or a linear zero-forcing (ZF) detector, or a combination thereof (see paragraph 80 “decoding techniques such as Zero-forcing & minimum square error”).

For claim 18 **Tarokh** teaches a method, further comprising:
terminating the obtaining, decoding, and determining if the decoded packet is correct or if the plurality of data symbol blocks for the data packet have been transmitted (see paragraph 25 “feedback mechanism”).

For claim 19 **Tarokh** teaches a method, further comprising:
sending an acknowledgment (ACK) for the data symbol block if the decoded packet is correct or a negative acknowledgment (NAK) if the decoded packet is in error (see paragraph 24 “ACK & NAK”).

For claim 22 **Tarokh** in view of **AAPA** teaches a method, further comprising:
deriving a signal-to-noise-and-interference ratio (SNR) estimate for each of the plurality of transmit antennas (see paragraph 59 “SNR and channel estimation function”),

computing an average SNR based on SNR estimates for the plurality of transmit antennas (see **Tarokh**: paragraph 59 “SNR with antenna” and paragraph 64 “SNR & CQI”),

determining a back-off factor (see paragraph 101 “delay diversity”), and
selecting a rate based on the average SNR and the back-off factor, for data transmission on a MIMO channel between the plurality of transmit antennas and the plurality of receive antennas, the selected rate indicating a particular data rate, or a particular coding scheme, or a particular code rate, or a particular modulation scheme, or a particular data packet size, or a combination thereof limitation (see **Tarokh**: paragraph 101 “delay diversity and data rate”).

For claims 28, 33, and 35 **Tarokh** teaches a method/receiver/apparatus of receiving an incremental redundancy (IR) transmission in a wireless multiple-input multiple-output (MIMO) communication system, comprising:

receiving a block of received symbols for a data packet, wherein the received symbol block is for a data symbol block transmitted from a plurality of transmit antennas at a transmitter and received by a plurality of receive antennas at a receiver, and wherein the data symbol block is one of a plurality of data symbol blocks generated for the data packet see abstract “obtained blocks of symbols are sent to the receiver”, paragraph 60 “the symbols from incoming signal and channel estimates are provided to the decoder”, and claim 21 f “STB is used to decode a first estimate for the original symbols”);

detecting all received symbol blocks received for the data packet to obtain detected symbol blocks, one detected symbol block for each received symbol block(see abstract and paragraphs 25, 42, 77, and 78 “symbol blocks are decoded to recover packets and determine whether there are errors to initiate HARQ”);

decoding the detected symbol blocks for the data packet to obtain decoder feedback information (see abstract “at the receiver is determined whether the received symbol is in error or not that determination information is used as a feedback to the transmitter”);

performing the detecting and decoding for a plurality of iterations, wherein the decoder feedback information from the decoding for a current iteration is used by the detecting for a subsequent iteration (see abstract “hybrid ARQ feedback mechanism”

Art Unit: 2464

paragraph 83 “iterative MMSE and MLD, can be used to improve the system performance”); and

generating a decoded packet based on an output from the decoding for a last iteration among the plurality of iteration (see abstract “hybrid ARQ feedback mechanism” paragraph 83 “iterative MMSE and MLD, can be used to improve the system performance”).

For claims 29 and 36 **Tarokh** teaches a method/apparatus, further comprising:
determining whether the decoded packet is correct or in error (see abstract “error detection”, and

repeating the receiving, detecting, decoding, performing, and generating for another one of the plurality of data symbol blocks if the decoded packet is in error and if all of the plurality of data symbol blocks have not been transmitted (see abstract “multiple of symbol blocks being communicated between transmitter and receiver in case received error automatic request is initiated with feedback mechanism that can be repeated until the correct symbol, packet or bit are received ARQ, and error detection” .

For claim 31 **Tarokh** teaches a method, wherein the detecting is based on a minimum mean square error (MMSE) detector, or a maximal ratio combining (MRC) detector, or a linear zero-forcing (ZF) detector, or a combination thereof (see paragraph 80 “decoding techniques such as Zero-forcing & minimum square error”).

For claim 32 **Tarokh** teaches a method, wherein the MMSE detector is used for the detecting for at least one iteration and the MRC detector or the ZF detector is used for the detecting after N iterations, the at least one iteration (see “iterative MMSE and MLD, an be used to improve the system performance-N is definite”).

For claim 34 **Tarokh** teaches a receiver, further comprising:

a controller operative to, if the decoded packet is in error and if all of the plurality of data symbol blocks have not been transmitted, direct the buffer to receive and store another received symbol block for another one of the plurality of data symbol blocks, and to direct the detector and decoder to perform detection and decoding on all received symbol blocks received for the data packet to obtain the decoded packet (see paragraph 70 “received signals stored from the first transmission along the symbol received during retransmission” and paragraph 79 receiver store received symbols in case they are not properly decoded”).

For claim 37 **Tarokh** teaches a method of receiving a data transmission in a wireless multiple-input multiple-output (MIMO) communication system, comprising:

detecting received symbols for a data packet to obtain detected symbols (see abstract “decode the received blocks of symbols”);

decoding the detected symbols to obtain decoder feedback information (see abstract “at the receiver is determined whether the received symbol is in error or not that determination information is used as a feedback to the transmitter”);

performing the detecting and decoding for a plurality of iterations, wherein the decoder feedback information from the decoding for a current iteration is used by the detecting for a subsequent iteration, wherein the detecting is performed based on a minimum mean square error (MMSE) detector for at least one iteration initially and thereafter based on a maximal ratio combining (MRC) detector or a linear zero-forcing (ZF) detector for remaining ones of the plurality of iterations (see paragraph 80 “decoding techniques such as Zero-forcing & minimum square error”, paragraph 83 “iterative MMSE and MLD”).; and

generating a decoded packet based on an output from the decoding for a last iteration among the plurality of iteration (see paragraph 83 “iterative MMSE”)

For claim 38 **Tarokh** teaches a method, wherein the detecting is performed based on the MMSE detector for only a first iteration and based on the MRC detector or the ZF detector for remaining ones of the plurality of iterations ~~N is equal to one~~ (see abstract the feedback mechanism perform as a loop when there is an error it feeds back the information to the transmitter the number of iteration can be programmed the number of iteration is at least one if there is an error. However, the number repetition can be set to any value 1 or greater than 1.”).

For claim 39 **Tarokh** teaches a method, further comprising:

transmitting the data packet and at least one additional data packet in an interlaced manner, wherein symbol blocks for each data packet are transmitted in slots spaced apart by a predetermined number of slots (see abstract “additional symbols are sent” Fig. 4 “SYMBOL INTERLEAVE & BIT INTERLEAVE” , Fig. 5 “SYMBOL DE-INTERLEAVE & BIT DE-INTERLEAVE” and paragraph 85 “next available time slot”).

8. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Tarokh et al. (US 2004/0057530 A1)** in view of **Alouini et al. (US 6,304,593 B1)** further in view of **Lakkis (US 7,031,371 B1)**.

For claim 21 **Tarokh** teaches a method of receiving an incremental redundancy (IR) transmission in a wireless multiple-input multiple-output (MIMO) communication system, comprising:

obtaining a block of detected symbols for a data packet, wherein the detected symbol block is an estimate of a data symbol block transmitted from a plurality of transmit antennas at a transmitter and received by a plurality of receive antennas at a receiver, and wherein the data symbol block is one of a plurality of data symbol blocks generated for the data packet based on the rate, each symbol block including different coded information for the data packet and being transmitted at most once to the receiver (see abstract “obtained blocks of symbols are sent to the receiver”, paragraph 60 “the symbols from incoming signal and channel estimates are provided to the decoder”, and claim 21 f “STB is used to decode a first estimate for the original symbols” and see claim 15);

decoding all detected symbol blocks obtained for the data packet to provide a decoded packet (see abstract and paragraphs 25, 42, 77, and 78 “symbol blocks are decoded to recover packets and determine whether there are errors to initiate HARQ”) ;

determining whether the decoded packet is correct or in error (see abstract and paragraphs 25 and 42 “symbol blocks are decoded to recover packets and determine whether there are errors to initiate HARQ”);

repeating the obtaining, decoding, and determining for another one of the plurality of data symbol blocks if the decoded packet is in error (see paragraph 24 “automatic repeat request (ARQ)”); and

Tarokh does not teach Determining a rate for data transmission based on an average spectral efficiency for a plurality of transmit antennas at a transmitter, the selected rate indicating a particular data rate, or a particular coding scheme, or a particular code rate, or a particular modulation scheme, or a particular data packet size, or a combination thereof.

However, **Alouini** teach this limitation (see column 2 lines 3-10 “average spectral efficiency definition and its relation to the data rate and bandwidth”). Thus, it would have been obvious to the person of ordinary skill in the art at the time of invention to use the teaching of **Alouini** with teaching **Tarokh** to arrive derive a formula for rate calculation.

This combination is possible because **Tarokh** teaches bandwidth and data rate and various coding, modulation, and decoding techniques.

The motivation for this combination is to optimize the overall throughput of MIMO data communication.

9. Claims 42-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Tarokh et al. (US 2004/0057530 A1)** in view of **Haustein et al. (US 7,366,520 B2)**.

For claim 42-48 **Tarokh** teaches a method/receiver/apparatus/, further comprising:

obtaining channel estimates for a MIMO channel between the plurality of transmit antennas and the plurality of receive antennas (see paragraph 57 "pilot signals are used for channel estimation"; and

Tarokh does teach selecting, based on the channel estimates, a rate for data transmission on the MIMO channel. However, **Haustein** teaches this limitation (see claim 1 "estimation of the channel matrix is determined at a symbol rate in dependence at the channel properties whereby making use of the reciprocity of MIMO channel").

Thus, it would have been obvious to the person of ordinary skill in the art at the time of invention to use the information taught by **Haustein** to draw various rate from the MIMO channel estimation.

The motivation for this combination is to enhance the overall throughput of MIMO channel.

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure: **Thomas et al. (US 6,987,819 B2)** and **Agrawal et al. (US 6,873,606 B2)**.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DAVID OVEISSI whose telephone number is (571)270-3127. The examiner can normally be reached on Monday to Friday 8:00 AM to 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ricky Ngo can be reached on (571) 272-3139. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Ricky Ngo/
Supervisory Patent Examiner, Art
Unit 2464

Application/Control Number: 10/801,624
Art Unit: 2464

Page 24
